

Summary of Breakout Sessions Prioritization Results from Day 2

Update of SSL R&D Agenda

Group 1: Inorganic SSL "Core Technology" Research

Task 1.1 Inorganic Materials Research	Number of Votes
1.1.1 Large-area substrates, buffer layers, and wafer research	24
1.1.2 High-efficiency semiconductor materials	51
1.1.3 Reliability and defect physics for improved emitter LED lifetime and efficiency	11
1.1.4 Conversion Materials ??? (1/4 for, and 3/4 against)	0

Task 1.2 Inorganic Device Architecture Research and Modeling	Number of Votes
1.2.1. Device approaches, structures and systems	39
1.2.2. Strategies for improved light extraction and manipulation	18

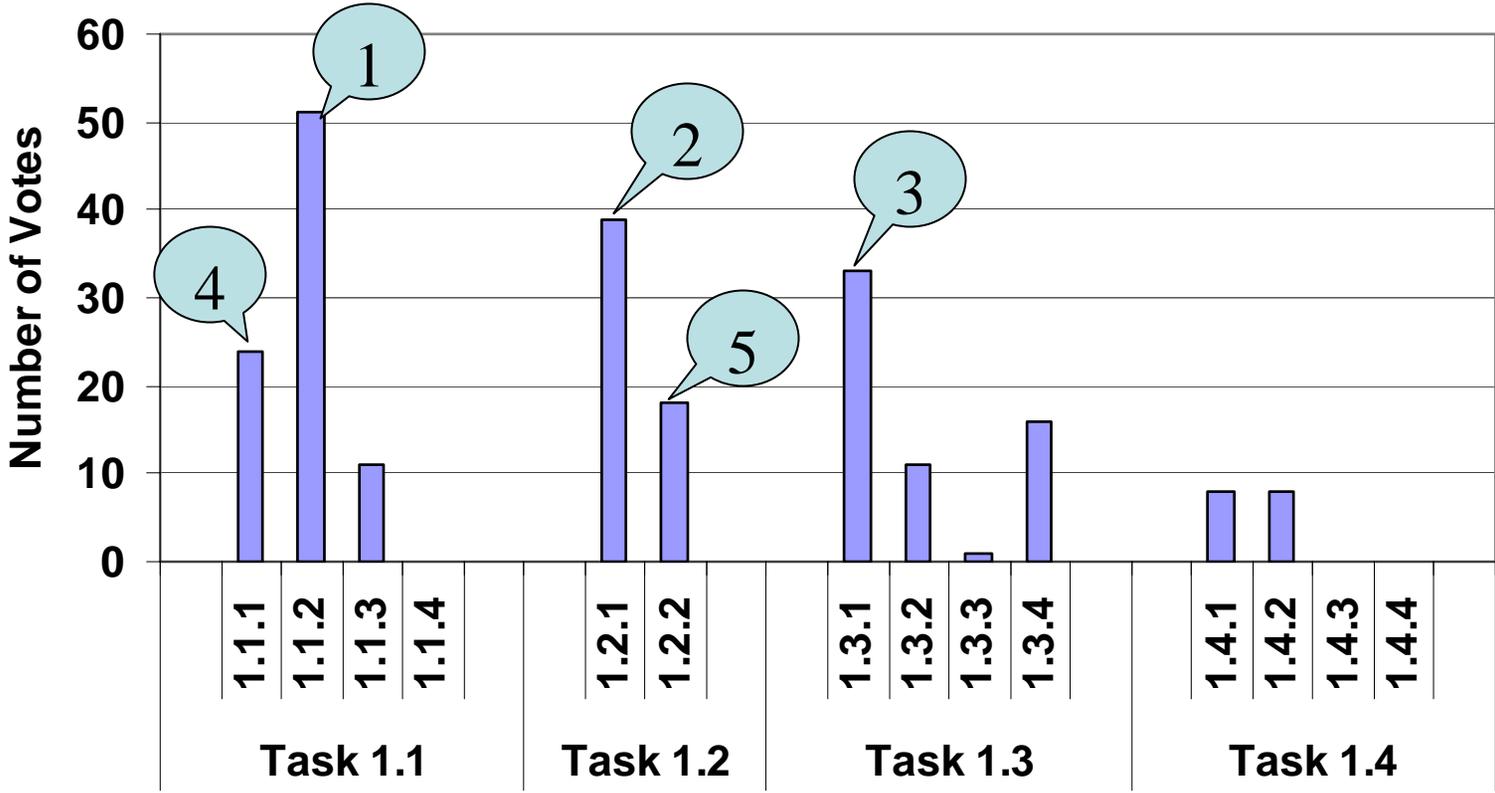
Task 1.3 Inorganic Integration Technology Integration Research	Number of Votes
1.3.1. High-Efficiency Phosphors and conversion materials	33
1.3.2. Encapsulants and packaging materials	11
1.3.3. Electrodes and interconnects	1
1.3.4. Measurement metrics and human factors	16

Task 1.4. Inorganic Growth and Fabrication Processes and Manufacturing Research Issues	Number of Votes
1.4.1. Physical, chemical, optical modeling, measurement, and experimentation for substrate and epitaxial processes	8
1.4.2. Design and development of in-situ diagnostic tools for substrate and epitaxial process	8
1.4.3. Research into low-cost, high-efficiency reactor designs and manufacturing methods	0
1.4.4. Investigation (theoretical and experimental) of die separation, chip shaping, and wafer bonding techniques	0

Subtask bullets

- Added, deleted and edited numerous illustrative bullets under subtasks.

Group 1: Inorganic "Core Technology" Research Distribution of High Priority Votes



Group 1: Top 5 – LED Core Technology

1.1.2 High-efficiency semiconductor materials	51
1.2.1. Device approaches, structures and systems	39
1.3.1. Phosphors and conversion materials	33
1.1.1 Large-area substrates, buffer layers, and wafer research	24
1.2.2. Strategies for improved light extraction and manipulation	18

Other comments from stakeholders

- Need to find the proper balance of funding among three groups: LED Core, LED Product, and OLED
- DOE should seek stakeholder input
- Look for more cross-fertilization between LED and OLED

Group 2: Inorganic SSL “Product Development”

Changes To Structure

- Participants wanted to change structure to reflect realities of product development
- Original Tasks 2.1 and Task 2.2 combined
- Original Task 2.3 split into two tasks
- No changes to Task 2.4
- Following slides (prioritization results) represent new structure

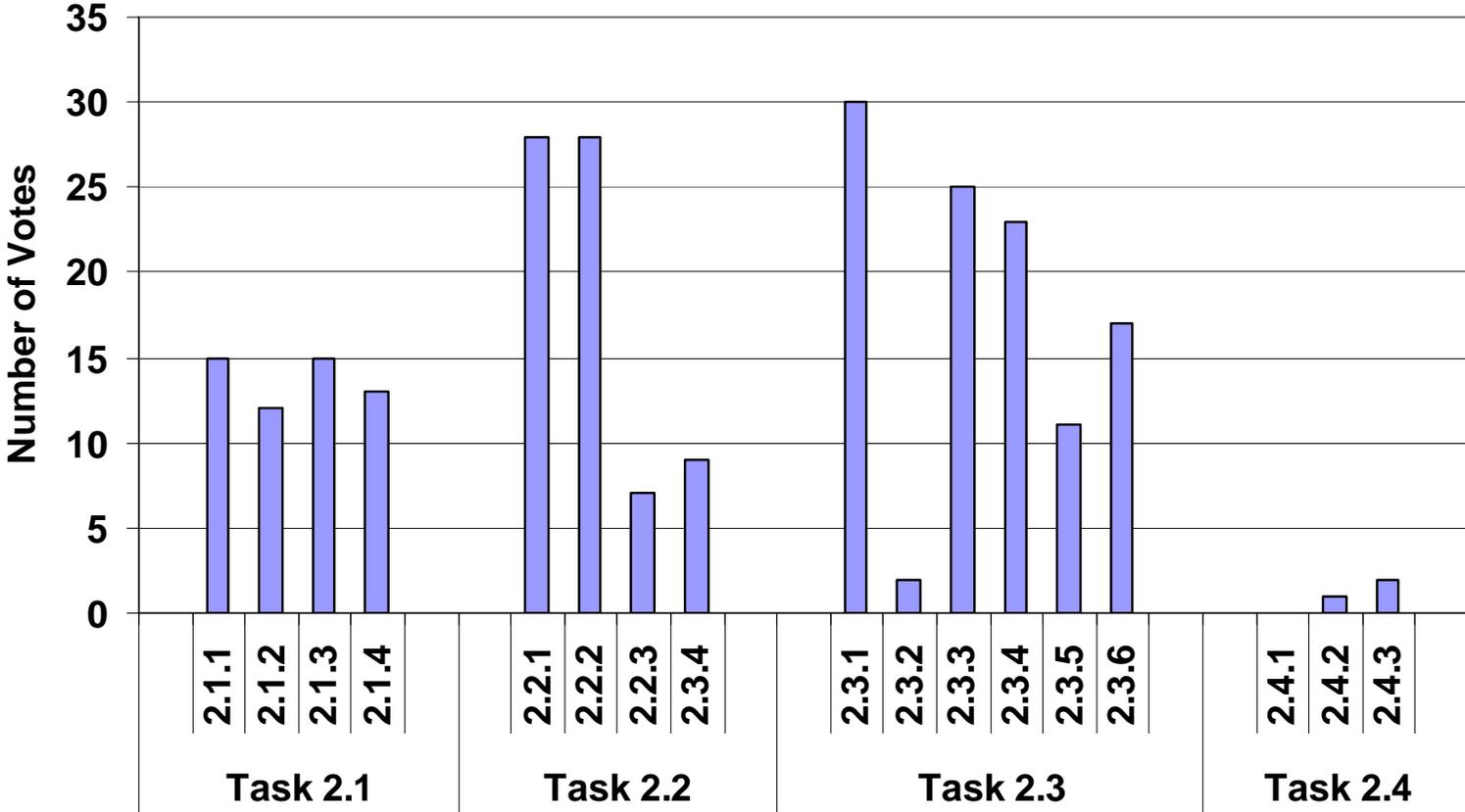
Task 2.1. Inorganic Materials and Device Architecture	Number of Votes
2.1.1. Substrate, buffer layer and wafer engineering and development	15
2.1.2. High-efficiency semiconductor materials	12
2.1.3. Implementing strategies for improved light extraction and manipulation	15
2.1.4. Device architectures with high power-conversion efficiencies	13

Task 2.2. LED Component Technical Integration	Number of Votes
2.2.1. Manufactured materials	28
2.2.2. LED packages and packaging materials	28
2.2.3 Modeling, distribution, and coupling issues	7
2.2.4 Evaluate component lifetime and performance characteristics	9

Task 2.3. System Technology Integration and Novel Luminaire Design	Number of Votes
2.3.1. Optical coupling and modeling	30
2.3.2 Mechanical design	2
2.3.3 Electronics development	25
2.3.4. Thermal design	23
2.3.5. Evaluate human factors and metrics	11
2.3.6. Evaluate systems lifetime and performance characteristics	17

Task 2.4. Inorganic Growth and Fabrication Processes and Manufacturing Issues	Number of Votes
2.4.1. Incorporate proven in-situ diagnostic tools into existing equipment	0
2.4.2. Develop low-cost, high-efficiency reactor designs	1
2.4.3. Develop techniques for die separation, chip shaping, and wafer bonding	2

Group 2: Inorganic "Product Development" Distribution of High Priority Votes



Group 2: Top 5 Subtasks

Subtask	Number of Votes
2.3.1 Optical coupling and modeling	30
2.2.1 Manufactured materials	28
2.2.2 LED packages and packaging materials	28
2.3.3 Electronics development	25
2.3.4. Thermal design	23

Group 3: Organic SSL "Core Technology" Research

Key Problems

- **Blue OLED – stable, efficient**
- **Low-cost Manufacturing – max lumens / min \$**
- **Overall white-light lifetime – materials / systems / packaging**
- **Fundamental Physics**
- **Standardization of Devices**

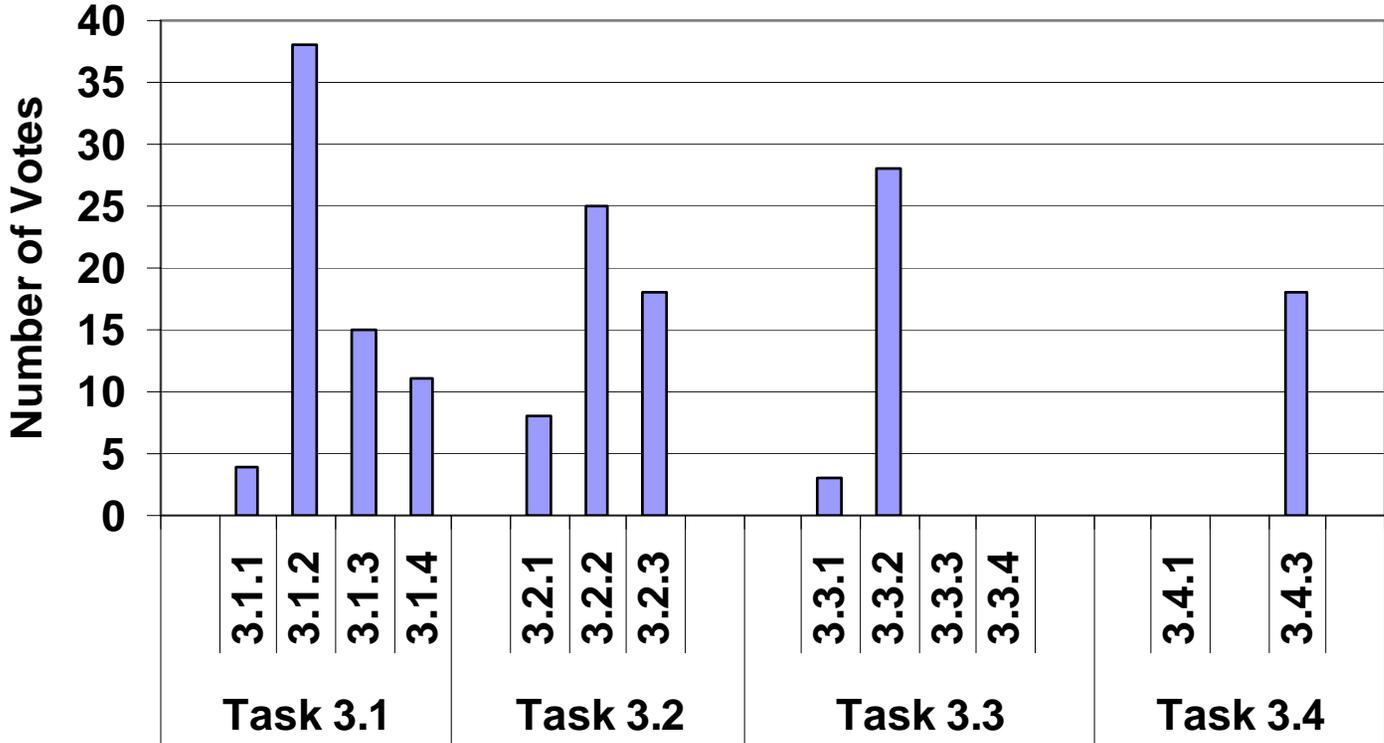
Task 3.1. Organic OLED Materials Research	Number of Votes
3.1.1. Substrates for electro-active organic materials substrate research	4
3.1.2. High-efficiency, low-voltage, stable materials (host, dopant and transport layers)	38
3.1.3. Improved contact materials and surface modification techniques to improve charge injection	15
3.1.4 Fundamental Physics	11

Task 3.2. Organic OLED Device Architecture Research and Modeling	Number of Votes
3.2.1. Strategies for improved light extraction and manipulation	8
3.2.2. Approaches, OLED structures between electrodes and systems for improved-performance low-cost white-light devices	25
3.2.3. Low-cost transparent electrode research	18

Task 3.3. Organic OLED Technology Integration	Number of Votes
3.3.1. Phosphors and Down conversion materials	3
3.3.2. Low-cost encapsulation and packaging technology materials	28
3.3.3. Electrodes and interconnects	0
3.3.4. Measurement metrics and human factors	0

Task 3.4. OLED Organic Growth and Fabrication Processes and Manufacturing Issues	Number of Votes
3.4.1. Physical, chemical and optical modeling for fabrication of OLED devices	0
3.4.2. Tools and methods for manufacturing	(moved to 4.4)
3.4.3. Investigation (theoretical and experimental) of low-cost fabrication and patterning techniques and tools	18

Group 3: Organic "Core Technology" Research Distribution of High Priority Votes



Group #3 Top 5 – OLED Core Technology

3.1.2 High-efficiency, low-voltage, stable materials	38
3.3.2 Low-cost Encapsulation and packaging technology	28
3.2.2 Approaches, OLED structures for improved-performance low-cost white-light devices	25
3.2.3 Low-Cost Transparent electrode research	18
3.4.3 Investigation (theoretical and experimental) of low-cost fabrication and patterning techniques and tools	18

Group 4: Organic SSL “Product Development”

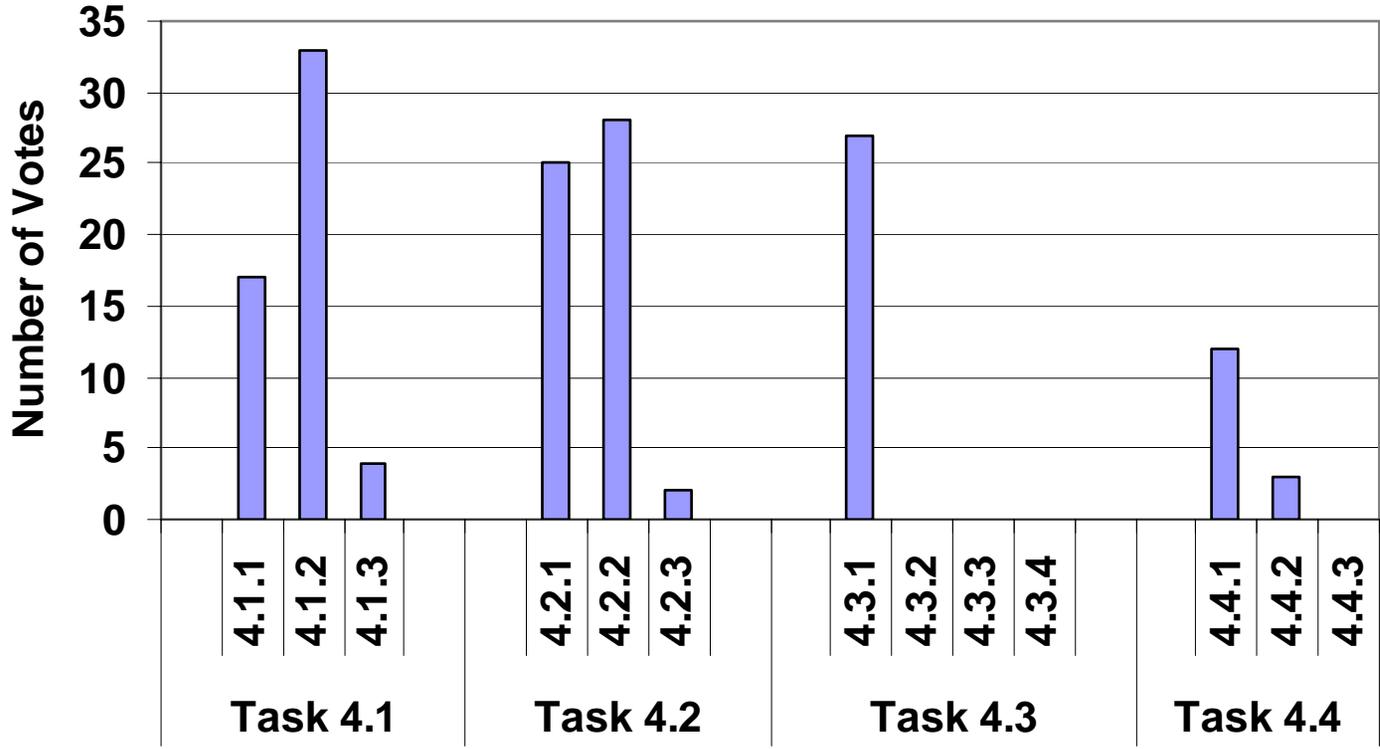
Task 4.1. Organic OLED Materials Development	Number of Votes
4.1.1. Substrates for electro-active organic materials substrate development	17
4.1.2. Between electrodes high-efficiency, low-voltage stable materials (host, dopant and transport layers)	33
4.1.3. Improved contact materials and surface modification techniques to improve charge injection	4

Task 4.2. Organic OLED Device Architecture Development	Number of Votes
4.2.1. Implementing strategies for improved light extraction and manipulation	25
4.2.2. Develop architectures that improve device robustness, increase lifetime and increase efficiency	28
4.2.3. Demonstrate device architectures: e.g., white-light engines (multi-color versus single emission)	2

Task 4.3. Organic OLED Technology Integration	Number of Votes
4.3.1. OLED encapsulation packaging for lighting applications	27
4.3.2. Characterization Simulation tools for modeling OLED devices	0
4.3.3. Voltage conversion, current density and power distribution and driver electronics	0
4.3.4. Luminaire design, engineered applications, field tests and demonstrations	0

Task 4.4. Organic OLED Growth and Fabrication Processes and Manufacturing Issues	Number of Votes
4.4.1. Module and process optimization and manufacturing	12
4.4.2. Synthesis Manufacturing Scale-up of active OLED materials	3
4.4.3. Tools for manufacturing the lighting module	0

Group 4: Organic "Product Development" Distribution of High Priority Votes



Group #4 Top 5 – OLED Product Development

4.1.2	Between Electrodes High-efficiency, low-voltage stable materials	33
4.2.2	Develop architectures that improve device robustness, increase lifetime and increase efficiency	28
4.3.1	OLED encapsulation packaging for lighting applications	27
4.2.1	Implementing strategies for improved light extraction and manipulation	25
4.1.1	Substrates for electro-active organic materials	17